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(19)

(54) PNEUMATIC TYRES

(71) We, DUNLOP LIMITED, a British Company of Dunlop House, Ryder Street, St. James's, London S.W.1., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to pneumatic tyres and more particularly to heavy duty radial ply tyres, for example, those suitable for use on trucks and other commercial vehicles.

Known tyres of this type comprise a carcass resinforced by a single ply of substantially radially extending inextensible cords, e.g. steel cords, and a tread supported by a breaker assembly made up of several plies of inextensible cords, two at least of which have a low bias angle, for example in the range 10° to 25°.

Current radial ply truck tyres of, for example, size 10.00-R-20 have tread widths of the order of 185 to 200 mm associated with radii of curvature of the tread radially outer surface in a meridian plane in the range 350 mm to 500 mm in the inflated but unloaded state.

We have now found however that in order to obtain a more uniform contact pressure distribution in the tyre ground contact area, and thus better grip and more even wear, the radius of the tread radially outer surface in a transverse plane should be greater i.e. this surface should have a flatter profile.

According to the present invention there is provided a heavy duty radial ply pneumatic tyre comprising a carcass reinforced by a single ply of substantially radially extending inextensible cords and a tread supported by a breaker assembly, the radius of the curvature of the radially outer surface of the tread in a meridian plane being such that the ratio of said radius of curvature to the axial width of the tread of the tyre is in the range of 2.75 to 1 to 3.5 to 1, the breaker assembly comprising at least three superimposed plies of inextensible cords, the cords of two of the plies having equal and opposite bias angles relative to the mid-circumferential plane of the tyre and the cords of a third ply having an angle relative to the mid-circumferential plane different to the angle to said plane of the cords of the said two plies.

In this way the lateral stiffness of the breaker assembly and hence the overall tread life may be optimized. Advantageously the cords of said two plies have an angle of 10°—25° preferably 15°—25°, and the cords of said third ply have an angle of 40°—70°, preferably 40°—50°. It is advantageous that the high angle ply is the outermost ply for the reason that this enables the higher angle ply to act also as protection for the two lower angle plies the latter being those which are tensioned on inflation of the tyre and hence are subjected to the higher load. It will be appreciated that the stiffening function of the higher angle layer will not be seriously impaired by damage to some of the cords therein e.g. by stone cutting when in use. In present radial ply truck tyres the higher angle ply is generally the innermost ply and a fourth breaker ply is frequently provided to carry out the function of protection of the low angle layers.

If desired the breaker assembly of the tyre of this invention may not be fully triangulated across its whole width but only in its side regions and not in the centre of the breaker. In one example of such a construction a discoupling layer of rubber is positioned in the centre region of the breaker assembly between two of the plies as described in U. K. Patent No. 1,327,195. In this way the stiff support may be provided where it is most needed, adjacent the tyre shoulders and the centre of the tyre tread may be more flexible to ensure good impact resistance.

Preferably the maximum axial width of the breaker assembly is in the range 90% to 110% of the axial width of the tread.

Although at the present time it is preferred that the inextensible cords are

steel cords it is anticipated that as other inextensible materials are developed they may become equally satisfactory for the purpose of this invention.

The invention will now be described by way of example with reference to the accompanying drawings of which:—

Figure 1 is a cross-sectional view of a tyre having a triangulated breaker assembly;

Figure 2 is a perspective cut-aqay view of the breaker assembly plies of the tyre of Fig. 1 showing their relative bias angles, and

Figures 3*a*, *b* and *c* show diagrammatically alternative breaker assembly ply arrangements.

As shown in Figure 1 a 10.00-R-20 tyre consists of a tread 1 supported by a breaker assembly consisting of three breaker plies 2, 3 and 4, beads 5 and sidewalls 6, a carcass ply 7 of radially orientated steel cords extending from bead to bead.

The radius of curvature R of the radially outer surface of the tread of the tyre in a meridian plane is 660 mm, and the axial width W of the tread is 215 mm whilst the maximum axial width B of the breaker assembly is 200 mm. The ratio of breaker width tread width is thus 93% and the ratio of tread radius to width is 3.02 to 1.

As shown more clearly in Figure 2 the breaker ply 2 consists of parallel steel cords at a bias angle of 45° to the mid-circumferential plane of the tyre whilst the breaker plies 3 and 4 consist of similar parallel steel cords and have equal and opposite bias angles of 18° to the mid-circumferential plane of the tyre, the ply 3 being biassed in an opposite sense from the ply 2.

In the tyre shown in Figures 1 and 2 referred to above the breaker assembly consists of breaker plies in which the widest ply is innermost and the narrowest ply is the outermost.

Figures 3*a*—*c* illustrate other arrangements of breaker plies which may be utilized if desired. In Figures 3 *a*, *b* and *c* the letter '*H*' is used to denote the ply of high bias angle (40° to 70°) and the letter '*L*' to denote the plies of lower bias angle (10° to 25°).

In Fig. 3*a*, the ply *H* is the radially innermost ply, the width arrangement being that the radially outermost ply L' is the narrowest and the adjacent ply *L* is the widest.

In Fig. 3*b*, the ply *H* is the radially outermost ply and the widths progressively, decrease radially inwardly, i.e. $H>L>L'$.

In Fig. 3*c* the ply *H* is again the radially outermost and widest ply, and the adjacent ply *L'* is the narrowest ply.

WHAT WE CLAIM IS:—

1. A heavy duty radial ply pneumatic tyre comprising a carcass reinforced by a singl ply of substantially radially extending inextensible cords and a tread supported by a breaker assembly, the radius of the curvature of the radially outer surface of the tread in a meridian plane being such that the ratio of said radius of curvature to the axial width of the tread of the tyre is in the range of 2.75 to 1 to 3.5 to 1, the breaker assembly comprising at least three superimposed plies of inextensible cords, the cords of two of the plies having equal and opposite bias angles relative to the mid-circumferential plane of the tyre and the cords of a third ply having an angle relative to the mid-circumferential plane different to the angle to said plane of the cords of the said two plies.

3. A tyre according to claim 1 or 2 wherein the angle of the cords of said two plies to said plane is in the range 10° to 25°.

4. A tyre according to claim 3 wherein said range is 15° to 25°.

5. A tyre according to any preceding claim wherein the angle of the cords of the third ply to said plane is in the range 40° to 70°.

6. A tyre according to claim 5 wherein said range is 40° to 50°.

7. A tyre according to any preceding claim wherein said third layer is the radially outermost layer of the assembly.

8. A tyre according to any preceding claim wherein the plies of the breaker assembly are not directly superimposed on each other across the full width of the assembly.

9. A tyre according to claim 8 wherein said plies are not directly superimposed in the centre of the assembly.

10. A tyre according to claim 8 or 9 wherein a discoupling layer of rubber is disposed between two of the plies in the central region of the assembly.

11. A tyre according to any preceding claim wherein the innermost ply of the assembly is narrower than at least one of the other plies.

12. A tyre according to claim 11 wherein the outermost ply is the widest ply.

13. A tyre according to any one of the preceding claims wherein the inextensible cords of at least the ply or plies of the breaker assembly are steel cords.

14. A tyre according to claim 1 substantially as described herein with reference to, and as illustrated in, Figures 1 and 2 of the accompanying drawings.

15. A tyre according to claim 1 substantially as described herein with

reference to, and as illustrated in, any one of Figur s 3 *a b* and *c* of the accompanying drawings.

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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 1

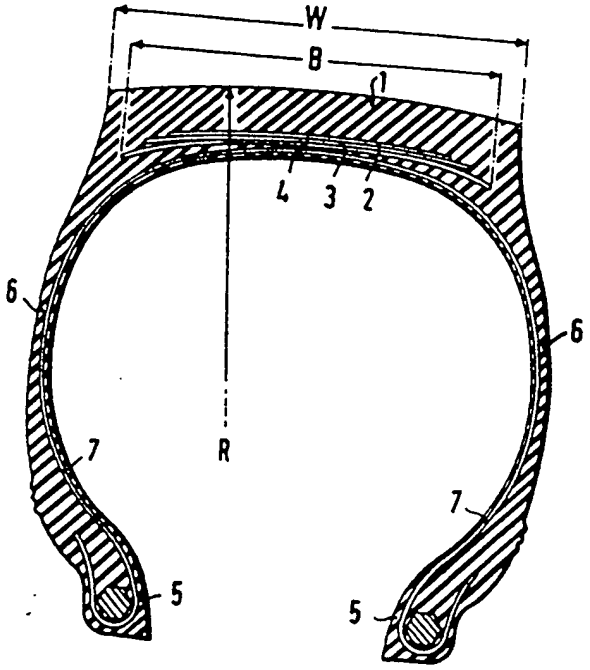

FIG.1

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

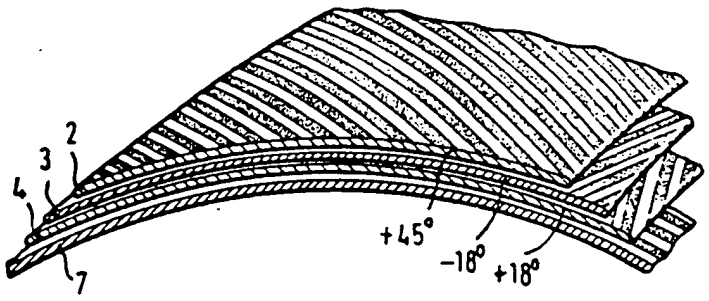

FIG.2

1483053 COMPLETE SPECIFICATION
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Sheet 3

FIG. 3a

FIG. 3b

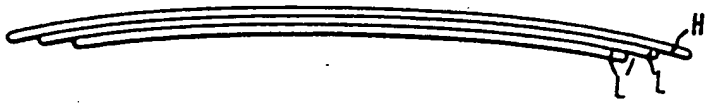

FIG. 3c